



# RESEARCH HIGHLIGHT

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## COSTING MECHANISM TO FACILITATE SUSTAINABLE COMMUNITY PLANNING— BACKGROUND RESEARCH AND COSTING FRAMEWORK

### INTRODUCTION

There has been much debate in recent years about the costs of development, both in terms of the true costs of different development forms as well how the costs of development are shared between the various public and private sectors. There is mounting evidence that more compact, mixed use development is a more cost-efficient and environmentally sustainable form of development than low density suburban development. However, there are very few readily available tools to demonstrate the degree to which this is true, or to effectively compare different types of development.

As documented in this report, there is also a lack of data to develop a full picture of neighbourhood development costs and revenues, specifically costs related to green infrastructure items, which are now gaining prominence in the development industry.

### OBJECTIVES

The ultimate intent of this project is to develop a tool that is available to anyone wanting to explore the costs of sustainable community development.

This project is being undertaken in two Phases. The purpose of Phase I, which is the subject of this report, was to conduct background research on the key costs for development, in particular those that can be influenced by sustainable community planning. The Phase I component of this project also conducted a review of available tools for sustainable community planning, and based on this research, it outlined a framework for the development of a costing tool.

Phase 2 of the project will involve the development of the costing tool itself. Phase 2 will also involve extensive testing and validation of the costing tool and underlying costing assumptions.

The purpose of this Phase I report is to provide interim findings on the project, specifically the results of the background research and recommendations for development of a costing tool. *Although the report also includes some preliminary costing results, these are intended to simply inform the development of the costing tool, as opposed to providing definitive answers on the costs of various development scenarios. All costing results should therefore be considered preliminary and for discussion purposes only.*

### RESEARCH APPROACH

In addition to the literature review of community planning cost/revenue indicators and available costing models, the Phase I research also involved an extensive effort to collect representative values for key cost components. In most cases, these costs were drawn from available sources for representative cities across Canada. The intent was to establish the range of potential costs and how they vary by development form, as the basis for developing a preliminary model.

The Phase I research also developed six representative scenarios for the purposes of guiding and testing the costing framework. These scenarios embody a wide range of contrasting locational and neighbourhood design characteristics.



The final step was to develop preliminary costs and revenues for each of these scenarios in order to explore the sensitivities of these costs and revenues to differing community planning parameters.

## FINDINGS

### Factors Affecting Community Development Costs and Revenues

As documented in this report, numerous studies have been carried out in an attempt to identify and quantify factors that influence the “cost” of development. One of the challenges in interpreting the results of these studies is that the conclusions often differ by the scale of analyses (neighbourhood vs. urban area), the type of study (retrospective or revealed results vs. simulated projections), the range of costs considered (hard infrastructure vs. total costs), the time period for analyses (initial development costs vs. lifecycle costs) and finally assumptions about who bears the costs (private developers, municipalities or the public).

Despite these differences in approaches, there are some common conclusions about the key factors influencing the cost of development. Almost exclusively, development density emerges as the main influence on the cost of urban growth. This is not surprising as most municipal infrastructure is linear (e.g. roads, water, sewers, transit) and the more densely developed communities are, the more people, employees, etc. can use a particular piece of infrastructure. On the other hand, there are many other municipal costs such as fire, police, schools and water/wastewater treatment facilities that are more directly proportional to population as opposed to density of development.

Another key determinant of the costs for new development is distance from existing infrastructure, and related to that, excess capacity within existing infrastructure to accommodate growth. It is generally more cost efficient to locate new development adjacent to existing plants, roads, etc. to minimize the cost of new infrastructure. Research has also shown that location within an urban area is also a significant determinant of user costs such as transportation costs, which are often underestimated or excluded in comparing development scenarios<sup>1</sup>.

### Scope or Costs and Revenues

A comprehensive literature review was undertaken to identify the key categories that should be considered in order to fully account for sustainable development costs. Based on this review, a full range of cost categories was identified for consideration in the costing tool. These can generally be grouped into four major categories:

- Hard Infrastructure, including: road, sewers, stormwater facilities, schools and recreation centres;
- Municipal Services, including: transit services, school transit, fire services, police services and waste management services;
- Private User Costs, including driving costs and home heating costs;
- External Costs, including: air pollution, climate change, motor vehicle collisions.

Most of the studies reviewed in the literature did not consider the costs and benefits of non-traditional or green infrastructure alternatives; however, these costs were considered to be of interest for this particular project. Green infrastructure alternatives considered in the initial costing framework included: bike lanes/paths, district heating/cooling systems, traffic calming, pervious pavement, solar orientation, distributed power generation, xeriscape landscaping, alternative road standards. Although these features were researched, their actual costs will not be quantified explicitly in the background research for the costing model due to the fact that the costs vary significantly by individual neighbourhood circumstances, degree of implementation, etc. For example, traffic calming options may range from simple speed humps to elaborate measures such as traffic circles and curb extensions. To accommodate these differences, it is recommended that the costing tool will provide some basic information on each measure and a range of potential costs.

Revenues from development were also quantified and included in the initial costing framework. The main revenues include property taxes and development charges. User fees such as water usage and transit fares were also considered and netted out from municipal operating costs. In the actual costing tool, it is recommended that user costs be detailed.

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<sup>1</sup> See for example, *Greenhouse Gas Emissions from Urban Travel, A Tool for Evaluating Neighbourhood Sustainability*, Canadian Mortgage and Housing Corporation, 2000.

## **Availability of Costing Tools**

As part of the Phase I project, the range of tools potentially available and their key advantages and disadvantages were documented. Tools or models reviewed included:

- Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighbourhood Sustainability
- SCALDS Model
- STEAM 2.0
- QUEST Model
- PLACES3
- Sierra Club Density Calculator
- SFLCV - This View of Density
- City Green
- Infra-Cycle

The review of existing models/tools indicates that there is no readily available model that meets all of the objectives of this study. The majority of studies, models and tools reviewed are focused on regional-level development decisions and are not applicable at the community or neighbourhood levels. The review also identified models that address specific elements of community planning/development, but cannot be extended to a more comprehensive costing approach. However, there are components of existing tools and reports that can be used as building blocks in the development of a new comprehensive tool. Specifically, the CMHC Tool for Evaluating Neighbourhood Sustainability, while not a costing tool per se, can provide useful input on the scenario development and establishment of relationships between urban form and performance measures such as vehicle use. The two reports conducted for CMHC in 1997 on conventional and alternative development patterns also provide a benchmark for the development of costs and revenues.

## **Directions for a New Costing Tool**

One of the key findings of the Phase I project is that quantifying the costs and benefits of sustainable community development is not a straightforward exercise. Many challenges exist in identifying what costs and revenues are to be included. For example, if the costs of schools are included in the development costs, these tend to over-shadow other costs. The range of potential costs found in the literature for specific items such as water treatment facilities and storm water management

facilities also varies due to both differences in operating practices and potentially the way costs and revenues are reported. Finally, the issue of "who pays" is one that is conceptually challenging. For example, a developer may pay for the initial construction cost of a street, but the municipality would pay for on-going maintenance and replacement.

Another key consideration in the estimation of development costs is the amount of residual capacity that is available for use by new development. Where there is residual capacity in the transportation, water/waste water or even educational facilities, for example in a brownfield area, this may lower the actual costs of development.

For all of the above reasons, it is considered important to have a costing tool that is flexible and can be tailored to a specific community or development scenario. Individual users may also be interested in different aspects of sustainable community planning costs or revenues.

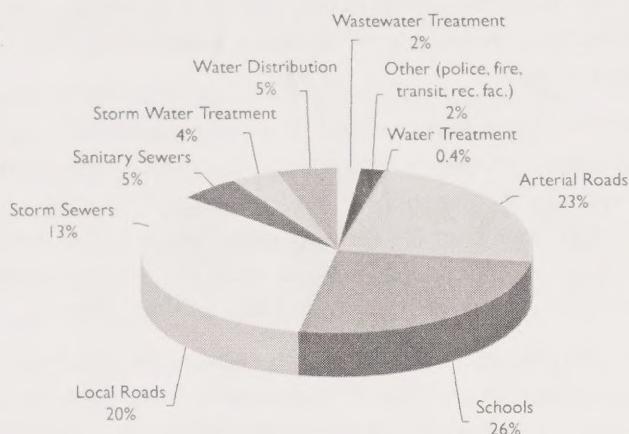
## **Representative Scenarios and Preliminary Costs**

In the Phase I work, a total of six distinct scenarios were developed to inform the costing framework and to present the range of potential costs and revenues from different development types. These scenarios were based on different combinations of neighbourhood characteristics and location within the urban area and included the following:

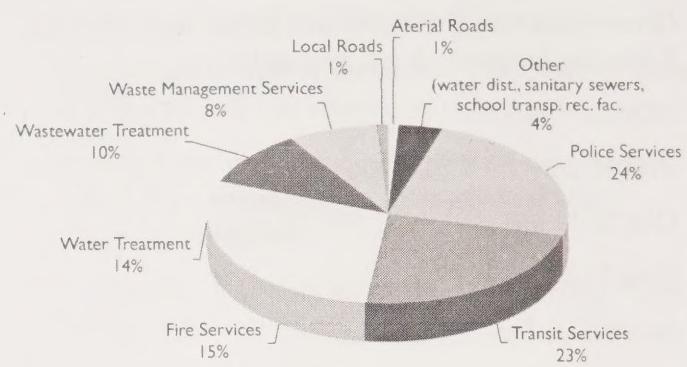
- A **High Density Mixed Use Neighbourhood in the Inner Area**
- A **Medium Density Neighbourhood in the Inner Area**
- A **Medium Density Neighbourhood in Inner Suburbs**
- A **Low Density neighbourhood in Inner Suburbs**
- A **Medium Density Neighbourhood in Outer Suburbs**
- A **Low Density neighbourhood in Outer Suburbs**

For the purpose of testing initial scenarios, all socio-economic variables (e.g. average household size, number of children and average incomes) were held constant. This was intentionally done so as not to bias the costs for any particular location or type of housing. In the actual model to be developed in Phase 2, users will have the option of varying socio-economic values by scenario.

### Capital Costs (Total Neighbourhood Costs)



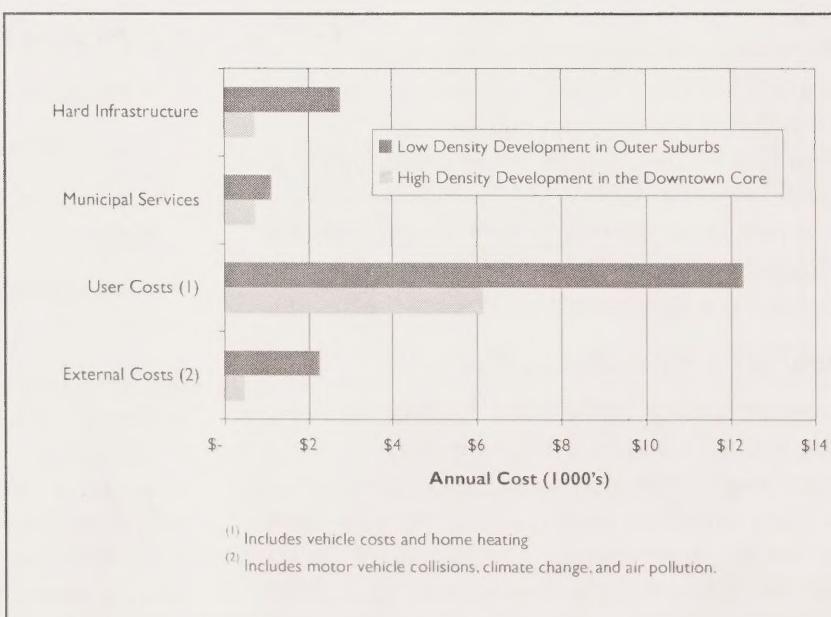
### Annual Operating and Maintenance costs (Total Neighbourhood Costs Excluding Schools)



*Exhibit ES.1: Distribution of Costs for an Average Neighbourhood*

As mentioned previously, the intent of Phase I was not to provide definitive costs for specific development scenarios. However, it is illustrative to compare the relative magnitudes of different development cost components in order to validate the costing assumptions.

Exhibit ES.1 provides a summary of the distribution of costs for an average of the six neighbourhood scenarios (weighted by number of units). These percentages are based on the total neighbourhood costs, including both residential and non-residential development. Aside from road costs, school costs represent the highest single capital expenditure for a residential-oriented development.



*Exhibit ES.2: Annualized Costs by Development Scenario (\$/household)*

(1) Includes vehicle costs and home heating

(2) Includes motor vehicle collisions, climate change and air pollution.

In terms of operating costs, police services, transit services and fire services account for the majority of costs. Excluded in figure ES.1 are the operating costs for schools, which are estimated to be more than 60 per cent of the operating costs for an average neighbourhood. The capital or operating costs of health care facilities have not been included in any of the comparisons as these are generally regional costs and do not vary by development form.

Exhibit ES.2 provides a summary of preliminary costs, expressed on a per household basis, for two of the six scenarios examined; the high density inner area development and the low density outer suburban development. These two scenarios bracket the costs and revenues for all six scenarios.

The following generalized conclusions on the cost of community development are as follows:

- Cost efficiency is a function of density – more compact neighbourhoods have lower costs per household;
- Capital costs vary more by scenario than operating costs;
- On a lifecycle cost basis (excluding revenues from property taxes and development charges), high density neighbourhoods in inner areas are as much as 50 per cent more cost efficient than low density outer suburbs neighbourhoods;
- External costs such as accidents and air pollution are significantly greater for low-density outer suburbs neighbourhoods.

Another important conclusion from the analysis is that user costs, of which the majority are related to vehicle ownership and operation, are higher than all other cost categories combined. Even more noteworthy is the fact that these costs vary significantly by type of development and location of development. Consumers often overlook the cost of owning and operating vehicles in housing purchases.

In terms of revenues, using assessment values and housing prices for Ottawa (as a representative case example), it was found that property taxes do not vary significantly by development scenario and range from \$3,000 – \$4,000 per year. On the other hand, development charges do vary considerably by scenario with a high density unit in the inner area costing about \$5,200 (initial costs) and a typical suburban home costing about \$18,600. When annualized over the life of a development, the costs of development charges are fairly low compared to annual property taxes and the differences between scenarios are not as apparent. It is also noted that the amount and implementation of development charges vary significantly between different municipalities.

## CONCLUSIONS

The Phase I component of the *Costing Mechanism to Facilitate Sustainable Community Planning Project* provides a strong foundation for moving ahead with the development of a user-friendly costing tool. There has been very strong interest in such a tool from the planning community, which is confirmation that comprehensive tools to inform sustainable community planning are not readily available, or require such a substantial effort to adapt them to specific areas/user needs that they are not widely pursued.

A costing mechanism that provides a full range of user flexibility combined with accurate and realistic costing assumptions will help contribute to more informed community planning decisions.

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### Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

To find more *Research Highlights* plus a wide variety of information products, visit our Web site at

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